Future Aviation Safety Concerns

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Some Future Concerns

- Pilot professionalism
  - Loss of military pipeline
  - Civilian filters inadequate
  - Recent troubling events
- Overzealous criminalization of accidents
  - Undercuts proactive information programs
  - Hinders investigations
  - Reduces likelihood of addressing system issues
- Increasing automation

Increasing Automation: Good News, Bad News

- More complexity increases likelihood that operators will not completely understand the system
- More reliability increases likelihood that operators have never seen a given malfunction before, even in training
- Automation often masks the problem of less proficient pilots – until something goes wrong

Examples

- Strasbourg, France (1992)
- Cali, Colombia (1995)
- Amsterdam, Holland (2009)
- Rio to Paris (2009)
- Miracle on the Hudson (2009)?
- San Francisco (2013)?

Strasbourg, France

- Risk Factors
  - Night, mountainous terrain
  - No ground radar
  - No ground-based glideslope guidance
  - No airborne terrain alerting equipment
- Very Sophisticated Autopilot
- Autopilot Mode Ambiguity

Human Factors Challenge

- "3.2" in the window, *with a decimal*, means:
  - Descend at a *3.2 degree angle (about 700 fpm at 140 knots)*
- "32" in the window, *without a decimal*, means:
  - Descend at *3200 fpm*

Flight data recorder readout program could have helped safety experts identify this problem

Clue: Quick changes in autopilot mode frequently signal a problem

Cali, Colombia

- Risk Factors
  - Night
  - Airport in deep valley
  - No ground radar
  - Airborne terrain alerting
    limited to “look-down”
  - Last minute change in approach
    - ➢ More rapid descent (throttles idle, spoilers)
    - ➢ Hurried reprogramming
- Navigation Radio Ambiguity
- Spoilers Do Not Retract With Power

Recommended Remedies:

- Operational
  - *Caution re last minute changes during the approach!!*
- Aircraft/Avionics
  - Enhanced ground proximity warning system
  - Spoilers that retract with max power
  - Require confirmation of non-obvious changes
  - Unused or passed waypoints remain in view
- Infrastructure
  - Eliminate single-letter navigational radio identifiers
  - Ground-based radar
  - Improved reporting of, and acting upon, safety issues

Amsterdam, Holland

- The Conditions
  - Malfunctioning left radar altimeter
  - Pilots selected right side autopilot
  - Aircraft vectored above glideslope
  - Autothrottles commanded throttles to idle

  - Unknown to pilots, right autopilot used left radar altimeter
  - Attempted go-around unsuccessful
- Queries:
  - Should autopilot default to same side altimeter?
  - More clarity re source of information? Ability to select?

Rio to Paris

- The Conditions
  - Cruise, autopilot engaged
  - Night, in clouds, turbulence, coffin corner
  - Ice blocked pitot tubes
  - Autopilot, autothrust inoperative without airspeed information
  - Alpha protections disabled
  - Pilots' responses inappropriate

- Queries:
  - Adequate redundancy?
  - More effective error message displays?
  - Reduction of startle effect, e.g., interim "virtual" airspeed?
  - Improved pilot training?
    - Loss of airspeed information in cruise
    - CRM – Importance of pilot knowing other pilot's actions
    - Manual flight at cruise altitude

Others

- Miracle on the Hudson, 2009?
  - Phugoid damping software restricted nose-up movement during flare into water
  - Different result if pilot had known?
- San Francisco, 2013?
  - Still under investigation

Conclusion

- Automation has significantly improved safety, reliability, and productivity
- We can and must address more effectively the human/machine interface challenges of increasingly complex and increasingly reliable automation

Thank You

Questions?